

Influence of Addition of Salts and Mixing on the Behaviour of an Ethanol Biofilter

W. Terán Pérez, F. Domenech*, S. Revah*, P. Christen

Laboratoire de Microbiologie, Institut de Recherche pour le Développement, CESB/ESIL, Case 925, Université de Provence, 13288 Marseille cedex 9. France.

* Dpto de Bio-ingeniería, Instituto Cubano de Investigación sobre los Derivados de la Caña de Azúcar, La Habana, Cuba.

* Dpto de Ingeniería de Procesos, Universidad Autónoma Metropolitana, México, Mexique.

A biofiltration system made with a pure culture of *Candida utilis* grown on sugarcane bagasse complemented with a mineral medium [1] was studied for ethanol removal from gaseous stream. The objective of this study was to improve the elimination capacity (EC) of the system by adding salts and by mixing the solid medium. Biofiltration experiments were conducted in a tubular reactor (Vol. = 0.165 l) filled with 12 g of dry matter (d.m.). Initial conditions were : pH, 6; temperature, 30°C; moisture content, 65%; packing density, 0.21 g/ml; inoculum size, 6.9×10^7 cells / g d.m. An ethanol load of 74.2 g/h.m^3 was fed to the reactor (ethanol concentration = 7.6 mg/l and air flow rate = 1.61 l/h). It was totally removed for a period of four days. Then, the EC of the system slowly decreased up to 76% at the ninth day. In the same time, acetaldehyde (0.127 mg/l) and ethyl acetate (0.008 mg/l) appeared in the outlet gas and the pH of the medium decreased. At this point, mineral medium (2.7 times initial concentration) was mixed to the solid matrix, and the homogenized medium was fed with the same ethanol load. It resulted in total removal of ethanol for a period of five days. At this point, the inlet ethanol concentration was increased to 16.5 mg/l to reach an ethanol load of 161 g/h.m^3 . A steady state with complete ethanol removal was maintained for two days, but it decreased again to 65%. At the same time, pH was 3.3 and significant amounts of acetaldehyde (0.69 mg/l) and ethyl acetate (0.045 mg/l) were found in the exit gas. At this point, a second addition of mineral medium (2.7 times initial concentration) was realized as done in the first case, but ammonium sulfate was replaced by ammonia in order to increase the pH to 7.7. Immediately, total ethanol elimination took place. Three days after the steady state establishment, the ethanol load was increased to 250 g/h.m^3 by increasing the air flow rate to 2.5 l/h. The system was found to be able to perform a complete ethanol elimination for six days. Final pH was 4.6 and water activity of the solid medium remained constant throughout the experiment close to 1. Final biomass was increased one hundred times (7×10^9 cells/ g d.m. corresponding to 56 mg protein / g d.m.), which also makes this process attractive for biomass production. Patterns of evolved carbon dioxide and ethanol removal were very similar. Respiratory quotient oscillated around the theoretical value of 0.67, characteristic of the complete mineralization of ethanol.

[1] K.C. Thomas, P.S.S. Dawson (1978). Can. J. Microbiol., 24, 1221-1237.

Teran Perez W., Domenech F., Revah S.,
Christen Pierre. (1999).

Influence of addition of salts and mixing on
the behaviour of an ethanol biofilter.

In : Biodépol'99 : les biotechnologies au
secours de l'environnement. Rennes : CBB
Développement, 1 p.

Biodépol'99 : les Biotechnologies au secours
de l'Environnement : Symposium Européen,
Rennes (France), 1999/10/26-27.